

**REMARKS**

As a preliminary matter, Applicant's representative would like to thank the Examiner for courtesies extended in the personal interview conducted on September 28, 2004. An Examiner's Interview Summary Record (PTOL-413) was provided by the Examiner at the interview. Applicant submits includes a Statement of Substance of Interview, as set forth below, to comply with the requirements of M.P.E.P. § 713.04.

Claims 1, 3, 5, 7-11 and 18-25 are all the claims presently pending in the application. Claim 10 is amended merely to make an editorial change to add proper punctuation.

Claims 19-25 are added to define more clearly and particularly the features of the claimed invention.

It is noted that the claim amendments are made only for more particularly pointing out the invention, and not for distinguishing the invention over the prior art, narrowing the claims or for any statutory requirements of patentability. Further, Applicant specifically states that no amendment to any claim herein should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

With respect to the prior art rejections, claims 1, 7, 9 and 18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Edmond, et al. (U.S. Patent No. 5,523,589) (hereinafter "Edmond") in view of Duggan (U.S. Patent No. 6,072,189; hereinafter "Duggan"). Claims 3, 5, 8, 10 and 11 stand rejected under U.S.C. § 103(a) as being unpatentable over Edmond in view of Duggan and in further view of Nitta, et al. (U.S. Patent No. 6,258,661; hereinafter "Nitta").

These rejections are respectfully traversed in the following discussion.

**I. STATEMENT OF SUBSTANCE OF INTERVIEW**

In the interview conducted on September 28, 2004, the following was discussed:

**A. Identification of claims discussed:**

Independent claim 1 and proposed new claims 19-24, as submitted herewith.

**B. Identification of prior art discussed:**

Edmond and Duggan.

**C. Identification of principal proposed amendments:**

Proposed new claims 19-24, as submitted herewith.

**D. Brief Identification of principal arguments:**

The Examiner further explained his interpretation of the references and the applied grounds of rejection.

Applicant's representative argued the patentability of the claims over the alleged combination of references. Particularly, Applicant's representative argued that the alleged combination of references would not disclose or suggest the claimed invention which improves the crystallinity of InGaN and improves emitted light intensity attained when InGaN is utilized for a light-emitting device (e.g., see specification at page 2, lines 11-13). Moreover, according to the claimed invention, not only the second layer (e.g., the light emitting layer) can be homoepitaxially grown on the first layer (e.g., the intervening layer), but also the two layers (e.g., the light emitting layer and the intervening layer) can be grown at substantially equal growth temperatures. As a result, the second layer can be formed with high (e.g., improved) crystallinity (e.g., see specification at page 2, lines 20-24).

Applicant's representative also discussed possible new claims 19-24 (as submitted herewith) and/or amendments to the claims (based on the new claims), for example, with respect to the formation of graded layers. Applicant's representative proposed adding new claims in response to the Examiner's positions set forth in the Response to Arguments (see Office Action at page 4, numbered paragraphs 14 and 15).

**E. Results of the Interview:**

No agreement was reached.

As discussed in the interview, Applicant submits this Amendment, which is consistent with the arguments set forth in the Examiner Interview, for the Examiner's formal review and consideration.

## II. APPLICANT'S INVENTION

The claimed invention is directed to a group III nitride compound semiconductor device of a successively laminated structure.

In an illustrative, non-limiting embodiment of the invention, as defined by independent claim 1, the device includes a substrate, a buffer layer formed directly on the substrate, an intervening layer formed directly on the buffer layer, the intervening layer comprising  $\text{In}_X\text{Ga}_{1-X}\text{N}$ , where  $0 < X < 1$ , a light-emitting layer formed directly on the intervening layer, the light-emitting layer comprising  $\text{In}_Y\text{Ga}_{1-Y}\text{N}$ , where  $0 < Y < 1$ , and a p-type clad layer formed directly on the light-emitting layer. A first In composition ratio of the intervening layer, X, changes from a first interface with the buffer layer to a second interface with the light-emitting layer, such that, the first In composition ratio, X, at the second interface becomes substantially equal to a second In composition ratio, Y, of the light-emitting layer.

In another exemplary embodiment of the invention, as defined by independent claim 3, a group III nitride compound semiconductor device of a successively laminated structure, includes a substrate, a buffer layer formed directly on the substrate and having a buffer layer lattice constant, an intervening layer formed directly on the buffer layer, the intervening layer comprising  $\text{Al}_a\text{Ga}_b\text{In}_{1-a-b}\text{N}$ , where  $0 < a < 1$ ,  $0 < b < 1$ , and  $a + b < 1$ , and a light-emitting layer formed directly on the intervening layer, the light-emitting layer comprising  $\text{In}_Y\text{Ga}_{1-Y}\text{N}$ , where  $0 < Y < 1$ , and having a light-emitting layer lattice constant. In the exemplary embodiment, composition ratios of at least Al and In of the intervening layer change from a first interface with the buffer layer to a second interface with the light-emitting layer, such that, a first lattice constant of the intervening layer at the first interface is lattice-matched to the buffer layer and changes to a second lattice constant at the second interface, which is substantially equal to the light-emitting layer lattice constant.

The claimed invention improves the crystallinity of InGaN and improves emitted light intensity attained when InGaN is utilized for a light-emitting device (e.g., see specification at page 2, lines 11-13).

According to the claimed invention, not only the second layer (e.g., the light emitting layer) can be homoepitaxially grown on the first layer (e.g., the intervening layer), but also the two layers (e.g., the light emitting layer and the intervening layer) can be grown at substantially equal growth temperatures. As a result, the second layer can be formed with high (e.g., improved) crystallinity (e.g., see specification at page 2, lines 20-24), while involving less manufacturing steps (and thus a less complex and costly device fabrication) and presumably a small device.

### III. THE PRIOR ART REJECTIONS

A. Claims 1, 7, 9 and 18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Edmond in view of Duggan.

The Examiner alleges that Edmond discloses, in the Abstract, that the addition of a graded layer can be used to reduce the interface strain and minimize dislocations and show that graded layers can be provided only between the clad layers and the active layers and that the graded layers can be provided between all the layers. The Examiner alleges that it would have been obvious to include the graded layers shown by Duggan for the advantage shown (e.g., see Office Action at page 2, numbered paragraph 3, lines 5-10, *citing* Duggan at column 7, line 64).

Applicant respectfully submits that in the Preliminary Amendment filed on May 21, 2004, it was submitted that the P-GaN layer (as shown exemplarily at reference numeral 6 in the non-limiting embodiment of Figure 1) according to the invention is not graded, and is disposed on the light-emitting layer (as shown exemplarily at reference numeral 5 in the non-limiting embodiment of claim 1).

Applicant submits that Duggan does not disclose or suggest such a feature, but instead, that the p-GaN layer disclosed in Duggan is disposed on the p-AlGaIn layer (i.e., the cladding layer 6), not directly on the light emitting layer (i.e., the active layer 5) as in the claimed invention.

First, in the Response to Arguments, the Examiner alleges that “*the p-GaN layer is not graded but since this is not a claimed feature it is not addressed*” by the Examiner (see Office Action at page 4, numbered paragraph 14).

Secondly, with respect to the p-GaN layer of Duggan, the Examiner alleges that “*this is not shown by the Examiner and note that the cover Figure is referred to*” (see Office Action at page 4, numbered paragraph 15).

Moreover, in the interview, the Examiner further took the position that Edmonds broadly disclosed that the heterostructure layers 26 and 27 could be any formula of  $A_xB_{1-x}N$ , wherein x is zero, one, or a fraction between zero and one (e.g., see Edmonds at column 5, lines 42-55), including Gallium Nitride (GaN).

For the following reasons, Applicant respectfully disagrees with the Examiner’s position, and therefore, traverses these rejections.

For example, independent claim 1 recites, *inter alia*, a group III nitride compound semiconductor device of a successively laminated structure, comprising:

- a substrate;
- a buffer layer formed directly on said substrate;
- an intervening layer formed directly on said buffer layer,  
said intervening layer comprising  $In_xGa_{1-x}N$ , where  $0 < X < 1$ ;
- a light-emitting layer formed directly on said intervening layer, said light-emitting layer comprising  $In_yGa_{1-y}N$ , where  $0 < Y < 1$ ; and
- a p-type clad layer formed directly on said light-emitting layer,  
wherein a first In composition ratio of said  
intervening layer, X, changes from a first interface with said  
buffer layer to a second interface with said light-emitting  
layer, such that, said first In composition ratio, X, at said  
second interface becomes substantially equal to a second In  
composition ratio, Y, of said light-emitting layer (emphasis  
added).

The claimed invention can improve the crystallinity of InGaN and can improve emitted light intensity attained when InGaN is utilized for a light-emitting device (e.g., see specification at page 2, lines 11-13).

According to the claimed invention, not only the light emitting layer can be homoepitaxially grown on the intervening layer, but also the two layers (e.g., the light emitting layer and the intervening layer) can be grown at substantially equal growth temperatures. As a result, the second layer can be formed with high (e.g., improved) crystallinity (e.g., see specification at page 2, lines 20-24).

In comparison, the Examiner modifies Edmonds based on Duggan to arrive at the claimed invention.

Applicant submits, however, that, even assuming *arguendo* that it would have been obvious to modify Edmonds based on Duggan, the alleged modification does not (and cannot) arrive at the claimed invention.

That is, Edmonds discloses heterostructure layers 26 and 27 formed on opposite sides of the active layer 25.

On the other hand, Duggan discloses an n-AlGa<sub>N</sub> cladding layer 4 on the lower side of the active layer InGa<sub>N</sub> 5 and a p-AlGa<sub>N</sub> cladding layer 6 formed on the upper side of the active layer InGa<sub>N</sub> 5.

As Applicant's representative argued in the interview, at a minimum, Duggan discloses a graded layer 42 disposed between the n-AlGa<sub>N</sub> cladding layer 4 and the active layer InGa<sub>N</sub> 5 and a graded layer 43 disposed between the p-AlGa<sub>N</sub> cladding layer 6 and the active layer InGa<sub>N</sub> 5 (e.g., see Duggan at Abstract, see also column 7, line 55 to column 8, line 5, and column 10, lines 33-40).

The Examiner alleges that modifying Edmonds based on Duggan would arrive at the claimed invention. However, Applicant respectfully disagrees with the Examiner's position.

For example, Applicant submits that, if Edmonds were modified to include the graded layers of Duggan, then the resulting combination would include, at a minimum, both of the graded layers 42 and 43 disposed on opposite sides of the active layer 25 of Edmonds (which would correspond to the active layer InGa<sub>N</sub> 5 of Duggan).

Thus, the resulting combination of Edmonds and Duggan would not (and could not) disclose or suggest "a p-type clad layer formed directly on said light-emitting layer", as claimed in claim 1, since, at a minimum, a graded layer must be disposed between the

light-emitting layer and any cladding layer formed above the active layer (e.g., active layer 25 of Edmonds or active layer 5 of Duggan), as specifically taught by Duggan.

As argued in the Interview by Applicant's representative, Edmonds and Duggan do not provide any suggestion or motivation (or for that matter even mention) providing the graded layer between only the lower cladding layer (e.g., the heterostructure layer 27 of Edmonds or the n-AlGaIn cladding layer 4 of Duggan), while forming the p-type clad layer directly on the light emitting layer (e.g., a graded layer is not formed between a p-type clad layer and the light-emitting layer). Moreover, the Examiner has not cited any such suggestion or motivation.

That is, when considering the Edmonds and Duggan references as a whole for what they fairly teach or suggest, the resulting combination clearly would not include a p-type clad layer formed directly on the light emitting layer, as claimed.

Applicant respectfully submits that the Examiner cannot "pick and choose" which elements of the Duggan reference would be combined with the Edmonds reference, absent some motivation or suggestion in the references themselves or in the art in general for such selective modifications. Indeed, the mere fact that references can be combined or modified is not sufficient to establish *prima facie* obviousness (see M.P.E.P. § 2143.01).

That is, merely identifying the individual elements of the claims in separate references is not sufficient to establish the obviousness of the claims. The Office Action must establish a reasonable motivation or suggestion for combining the references to arrive at the claimed invention (e.g., see M.P.E.P. § 2145). That is, there must be a reasonable motivation to do that which the patent Applicant has done.

In this case, even if the Examiner's proposed modification were reasonable, the resulting combination would still require further modification in order to arrive at the claimed invention.

However, since neither Edmonds nor Duggan provides a reasonable motivation or suggestion for the additional modifications of the resulting combination that would be necessary to arrive at the claimed invention, it is clear that improper hindsight based

analysis is being used to form the basis for the additional modifications to the resulting combination.

Thus, Applicant respectfully submits that the resulting combination of these references, as alleged in the Office Action, would not disclose or suggest at least “a p-type clad layer formed directly on said light emitting layer,” as claimed in claim 1.

Moreover, Applicant respectfully notes that the Examiner has not responded to, or even mentioned, Applicant’s traversal position with respect to the failure of the previous Office Action to establish a *prima facie* case of obviousness. Applicant submits that, where the Applicant traverses any rejection, the Examiner should, if he repeats the rejection, take note of the Applicant’s argument and answer the substance of it (e.g., see M.P.E.P. § 707.07(f)).

Indeed, the present Office Action does not express a reasonable motivation for combining the Edmonds and Duggan references, other than merely stating that it would have been obvious to include “*the graded layers shown by Duggan for the advantage shown*,” which presumably means the advantage shown by Duggan.

However, the Examiner did not explain *how* such a combination would arrive at the claimed invention or *why* the ordinarily skilled artisan would have been motivated to combine the references to arrive at the claimed invention, absent impermissible hindsight based analysis. Conclusory and unsupported statements clearly are not sufficient to establish a *prima facie* case of obviousness, as set forth in a myriad of recent Federal Circuit decisions.

Indeed, as set forth above, the resulting combination of Edmonds and Duggan could not arrive at the claimed combination, which includes “a p-type clad layer formed directly on said light emitting layer,” as claimed in claim 1, without further modifying the resulting combination of references.

Thus, for at least the foregoing reasons, Applicant submits that Edmonds and Duggan, either alone or in combination, do not disclose or suggest all of the features of independent claim 1, including “a p-type clad layer formed directly on said light emitting layer.”



On the other hand, claim 18 recites, *inter alia*, that “said p-type clad layer consists of GaN” (emphasis added).

In the present Office Action, the Examiner merely alleges that Edmonds shows that layer 26 is GaN (e.g., see Office Action at page 3, numbered paragraph 6).

However, it is unclear how any combination of Edmonds and Duggan would arrive at the claimed invention, in which a p-type clad layer consisting of GaN is formed directly on the light emitting layer, as claimed in claim 18 (i.e., claim 1 + claim 18).

That is, merely alleging that Edmonds discloses a GaN layer clearly is not sufficient to establish the *prima facie* obviousness of combining Edmonds and Duggan to arrive at the claimed invention (e.g., modifying Edmonds based on Duggan to include the graded layer 42, but not the graded layer 43, and then using GaN as the cladding layer and forming such a GaN cladding layer directly on the active layer).

As set forth above, the Examiner cannot rely on Duggan for disclosing the missing features of Edmonds, and then simply ignore some of the teachings of Duggan that do not assist in arriving at the claimed invention. Instead, the references must be considered as a whole for what they would fairly teach to the ordinarily skilled artisan.

Applicant submits that modifying Edmonds based on selective portions of Duggan, without establishing a reasonable motivation or suggestion in the references themselves, or in the art in general, for such selective modifications to the references, clearly shows that the rejection is using improper hindsight-based analysis to arrive at the claimed invention.

For the foregoing reasons, Applicant respectfully submits that the Office Action has not established a reasonable motivation or suggestion for combining the references to arrive at the claimed invention. Instead, Applicant respectfully submit that the Office Action merely picks and chooses selective portions of the references, rather than considering the references as a whole, and then combines those selective portions to arrive at the claimed invention, without establishing a reasonable motivation or suggestion for doing so.

Moreover, the present Office Action has not properly responded to all of Applicant's traversal positions, particularly with respect to the motivation to combine the references.

Thus, Applicant submits that the alleged combination of Edmonds and Duggan would not disclose or suggest at least "a p-type clad layer formed directly on said light-emitting layer" as claimed in independent claim 1 (emphasis added).

**B.** Claims 3, 5, 8, 10 and 11 stand rejected under U.S.C. § 103(a) as being unpatentable over Edmond in view of Duggan and in further view of Nitta.

Applicant respectfully submits that the Examiner has not responded to Applicant's traversal position with respect to the alleged combination of Edmond, Duggan, and Nitta, as set forth in the Amendment under 37 C.F.R. § 1.116 filed on April 21, 2004.

Instead, the Examiner has merely re-stated the previous rejection without responding to Applicant's traversal arguments.

Applicant submits that where Applicant traverses any rejection, the Examiner should, if he repeats the rejection, take note of Applicant's argument and answer the substance of it (e.g., see M.P.E.P. § 707.07(f)).

Therefore, Applicant reiterates the traversal arguments set forth in the Amendment filed on April 21, 2004 (which is incorporated herein by reference for the Examiner's convenience).

To summarize, Applicant noted that the Examiner recited Nitta for teaching a blue light emitter where the active layer 104 can be InGaN and the clad layer can be InAlGaN and that the wavelength of the emitted light can be adjusted by varying the compound to provide sufficient optical confinement and to use a compound to increase the wavelength available.

However, Applicant argued that, as is known to one of ordinary skill in the art, grading the In composition layer within the gallium-nitride-based n-type semiconductor clad layer 103 to form the n side of a pn junction that forms a light emitting region, would defeat Nitta's purpose of selecting a particular composition ratio of In for a corresponding selected wavelength of light.

The Examiner's proposed modification of Nitta by the graded layers of Duggan would render the invention of Nitta unsatisfactory for its intended purpose. Thus, Applicant argued that there would have been no suggestion or motivation to make the Examiner's proposed modification. See, MPEP §2143.04.

Moreover, Applicant argued that the proposed combination of Duggan with Edmond does not properly constitute a *prima facie* case of obviousness under 35 U.S.C. §103(a) because nowhere does Edmond suggest the desirability of such a combination, as required by *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). Likewise, nowhere does Nitta suggest the desirability of such a combination. Therefore, Applicant further submitted that the combination of Duggan with Edmond and/or Nitta would not properly constitute a *prima facie* case of obviousness under 35 U.S.C. §103(a).

For the foregoing reasons, Applicant respectfully submits that claims 3, 5, 8, 10 and 11 would not have been obvious over Edmond in view of Duggan and in further view of Nitta. Therefore, Applicant requests that the Examiner withdraw this rejection and permit these claims to pass to allowance.

#### **IV. NEW CLAIMS**

New claims 19-25 have been added to provide more varied protection for the present invention.

Applicant submits that new claims 19-25 are patentable over the art of record for somewhat similar reasons as those set forth above.

Moreover, as mentioned above and as discussed in the interview conducted on September 28, 2004, Applicant submits that claims 19-25 would not have been anticipated or rendered obvious from the cited references, either alone or in combination, by virtue of the additional features recited therein.

For example, claim 19 recites, *inter alia*, that "said p-type clad layer comprises an ungraded p-type clad layer" (emphasis added).

On the other hand, claim 20 recites, *inter alia*, that "said GaN layer comprises an ungraded GaN layer" (emphasis added).

Claim 21 recites, *inter alia*, that “a p-type clad layer is formed directly on said light-emitting layer” (emphasis added).

On the other hand, claims 22 recites, *inter alia*, that “said p-type clad layer consists of GaN” (emphasis added).

Moreover, claim 23 recites, *inter alia*, that “said p-type clad layer comprises an ungraded p-type clad layer” (emphasis added).

On the other hand, claim 24 recites, *inter alia*, that “said GaN layer comprises an ungraded GaN layer” (emphasis added).

Further, independent claim 25 defines a group III nitride compound semiconductor device of a successively laminated structure, including:

- a substrate;
- a buffer layer formed directly on said substrate and having a buffer layer lattice constant;
- an intervening layer formed directly on said buffer layer, said intervening layer comprising  $\text{Al}_a\text{Ga}_b\text{In}_{1-a-b}\text{N}$ , where  $0 < a < 1$ ,  $0 < b < 1$ , and  $a + b < 1$ ;
- a light-emitting layer formed directly on said intervening layer, said light-emitting layer comprising  $\text{In}_Y\text{Ga}_{1-Y}\text{N}$ , where  $0 < Y < 1$ , and having a light-emitting layer lattice constant;
- and
- a p-type clad layer formed directly on said light-emitting layer,
- wherein said p-type clad layer comprises an ungraded GaN layer, and
- wherein composition ratios of at least Al and In of said intervening layer change from a first interface with said buffer layer to a second interface with said light-emitting layer, such that, a first lattice constant of said intervening layer at said first interface is lattice-matched to said buffer layer and changes to a second lattice constant at said second interface, which is substantially equal to said light-emitting layer lattice constant (emphasis added).

Applicant submits that none of the cited references, either alone or in combination, discloses or suggests all of the novel and unobvious combination of elements of the claimed invention, as recited in claims 21-25.

Accordingly, Applicant requests that the Examiner permit new claims 21-25 to pass to immediate allowance.

**V. FORMAL MATTERS AND CONCLUSION**

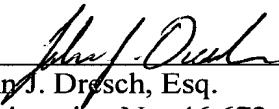
In view of the foregoing, Applicant submits that claims 1, 3, 5, 7-11 and 18-25, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully submitted,

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John J. Dresch, Esq.  
Registration No. 46,672

Sean M. McGinn, Esq.  
Registration No. 34,386

**McGinn & Gibb, PLLC**  
8321 Old Courthouse Road, Suite 200  
Vienna, VA 22182-3817  
(703) 761-4100  
**Customer No. 21254**